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FREE ENERGY FROM TESLA'S WIRELESS ELECTRICITY

The wireless electricity transmission system pioneered by Dr Nikola Tesla has the potential to meet our future global energy needs, if only the funding and organisational structures can be put in place as a matter of urgency.

by Thomas Valone, PhD, PE
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The Wardenclyffe Tower Centennial in 2003 was an opportunity to celebrate a monument to Dr Nikola Tesla's visionary genius. Recently, a resurgence of interest from prominent physicists has focused on the unusual method of pulsing a broadband Tesla coil at a repetition rate of 8 Hz to resonate with the Earth's Schumann cavity.[1] Nikola Tesla, the father of AC electricity, is responsible for recognising that an atmospheric and a terrestrial storage battery already exists everywhere on Earth, for the benefit of mankind. This is perhaps the "wheelwork of nature" to which Tesla was referring.[2] A century later, only a few visionary scientists recognise the untapped renewable reservoir of *terawatts of electrical power* (3,000 gigawatts) that sits dormant above us, waiting to be utilised.

THE ELECTRICITY TRANSMISSION GRIDLOCK

In 2001, the Bush-mandated National Transmission Grid Study (NTGS 2001) was designed to identify the major transmission bottlenecks across the United States and identify technical and economic issues resulting from these transmission constraints. With deregulation of US utilities and the lack of jurisdiction for the Federal Energy Regulatory Commission (FERC), the US is fighting an electrical energy crisis which, right now, costs consumers hundreds of millions of dollars annually due to interregional transmission congestion. There is no longer any economic incentive nor any FERC eminent domain for states to provide rights-of-way, besides the lack of Federal compensation to utilities to build new transmission lines.

Historically, the creation of electrical utilities was beset with scandal, such as the six years of congressional hearings starting in 1928 in which "thousands of pages of testimony revealed a systematic, covert attempt to shape opinion in favor of private utilities, in which half truths and at times outright lies presented municipal systems in a consistently bad light".[3] Today, US AID funds the US Energy Association to train utility representatives from the former Russian states on how to monitor electricity usage reliably and collect money from customers in their respective countries, while those economically challenged people struggle for sufficient wages.

At a December 2001 Washington, DC, conference which this author attended, called "Implementing a National Energy Strategy: Breaking Down the Barriers" and sponsored by the US Energy Association, only the depressing news about unresolved US electricity headaches was discussed. *Energy Daily* publisher Llewelyn King finally concluded: "We are using 19th-century technology for electrical transmission." He then called for a paradigm shift toward new technology and cited the "monster infrastructure problems" within the US as compared to the developing countries.

In June 2003, the US Department of Energy (DOE) held an emergency meeting with utility heads as a natural gas crisis loomed from the lack of diversification of new electrical power generation facilities. "Innovation in new technology and renewable sources [is] needed in the long term to improve the environment and meet rising demand", summarised an *Investors Business Daily* editor on the crisis.[4]

In November 2002, the American Council for The United Nations University called for *wireless energy transmission* to circumvent the need for transmission lines, as part of its Millennium Project. It announced that new funding is being offered by the National Science Foundation (NSF) in collaboration with NASA and the Electrical Power Research Institute (EPRI). The beaming of microwave energy and the creation of a world energy organisation were seen to actively address the 2020 challenges to global electricity supply,

especially in areas of massive urban concentration.[5]

In 1940, "the United States prided itself on using half the world's electricity".[6] Since 1980, the US has also *doubled* its dependence on foreign oil and *doubled* its electrical transmission grid inefficiency. From 31 quads (quadrillion BTUs) generated, *two-thirds is totally wasted* in "conversion losses", with only about 11 quads (3.7 trillion kWh) delivered to the end-user.[7] Instead of trying to build two power plants per week (at 300 MW each) for the next 20 years (only to have a total of an additional 6.0 trillion kWh available by 2020), as the Bush–Cheney administration wants to do, we simply need to *eliminate the 7.0 trillion kWh of conversion losses* in our present electricity generation modality.

HISTORY OF TESLA'S WIRELESS ENERGY

The fateful decision in 1905 by J. P. Morgan to abandon Tesla's Wardenclyffe Tower project on Long Island (after investing US$150,000) was a result of learning that it would be designed mainly for *wireless transmission of electrical power* rather than for telegraphy. No more money was forthcoming for the project that Morgan initiated, even when the equipment alone cost about $200,000. Morgan believed that he would "have nothing to sell except antennas [and refused] to contribute to that charity".[8]

Tesla tried and tried for years until, in 1917, the US government blew up the abandoned Wardenclyffe Tower because suspected German spies were seen "lurking" around it. With Edison as his willing ally, Morgan even publicly discredited Tesla's name, so that all of the five school textbook publishers of the time removed any reference to him. Is it any wonder why, even today, 100 years later, hardly anyone knows who Tesla is?

The fateful decision in 1905 by J. P. Morgan to abandon Tesla's Wardenclyffe Tower project was a result of learning that it would be designed mainly for wireless transmission of electrical power rather than for telegraphy.

The rest of this article will present a physics and electrical engineering argument for a subsequently forgotten engineering alternative for energy generation and transmission.

As Tesla experimented with a 1.5 MW system in 1899 at Colorado Springs, he was amazed to find that pulses of electricity he sent out passed across the entire globe and *returned with "undiminished strength"*. He said: "It was a result so unbelievable that the revelation at first almost stunned me."[9] This verified the tremendous efficiency of his peculiar method of pumping current into a spherical ball to charge it up before discharging it as a pulse of electrical energy: a *"longitudinal" acoustic type of compression wave*, rather than an electromagnetic Hertzian type of transverse wave. It was therefore more akin to electrostatic discharge than wave mechanics.

Tesla also planned to include a *stationary resonant wave* creation globally, within the Earth–ionosphere cavity, as part of the wireless transmission of power. Examining the pair of 1900 patents, #645,576 and #649,621, each using the same figure on the first page, we find in the first patent that Tesla designed a quarter-wave antenna (50 miles of secondary coil wire for a 200-mile-long wavelength). More important is the sphere on the top which is supposed to be a conductive surface on a balloon, raised high enough to be radiating in "rarefied air".[10]

As Tesla stated: "That communication without wires to any point of the globe is practical with such apparatus would need no demonstration, but through a discovery which I made I obtained absolute certitude. Popularly explained, it is exactly this: When we raise the voice and hear an echo in reply, we know that the sound of the voice must have reached a distant wall, or boundary, and must have been reflected from the same. Exactly as the sound, so an electrical wave is reflected, and the same evidence which is afforded by an echo is offered by an electrical phenomenon known as a 'stationary' wave—that is, a wave with fixed nodal and ventral regions. Instead of sending sound vibrations toward a distant wall, I have sent electrical vibrations toward the remote boundaries of the earth, and, instead of the wall the earth has replied. In place of an echo I have obtained a stationary electrical wave, a wave reflected from afar."[11]

Nikola Tesla's discovery of pulsed propagation of energy does not resemble the standard transverse electromagnetic waves so familiar to electrical engineers everywhere. Many engineers and physicists have dismissed Tesla's wireless energy transmission as unscientific, without examining the unusual characteristics and benefits of longitudinal waves—which are the z-component solutions of Maxwell's equations.

Tesla wrote: "That electrical energy can be economically transmitted without wires to any terrestrial distance, I have unmistakably established in numerous observations, experiments and measurements, qualitative and quantitative. These have demonstrated that it is practicable to distribute power from a central plant in unlimited amounts, with a loss not exceeding a small fraction of one per cent in the transmission, even to the greatest distance, twelve thousand miles—to the opposite end of the globe."[12]

Tesla was an electrical genius who revolutionised our world with AC power in a way that DC power could never have accomplished, since the resistance of any transmission lines (except, perhaps, superconductive ones) is *prohibitive* for direct current. He deserved much better treatment from the tycoons of his age, than to spend the last 40 years of his life in abject poverty. However, he was too much of a gentleman to hold a grudge. Instead, regarding the magnifying transmitter, Tesla wrote in his autobiography: "I am unwilling to accord to some small-minded and jealous individuals the satisfaction of having thwarted my efforts. These men are to me nothing more than microbes of a nasty disease. My project was retarded by laws of nature. *The world was not prepared for it. It was too far ahead of time. But the same laws will prevail in the end and make it a triumphal success.*"[13]

TESLA'S WORLD SYSTEM

Tesla's "World System" was conceptually based on three of his inventions:

1. The **Tesla Transformer** (Tesla coil);
2. The **Magnifying Transmitter** (transformer adapted to excite the Earth);
3. The **Wireless System** (efficient transmission of electrical energy without wires).

Tesla stated: "The first World System power plant can be put in operation in nine months. With this power plant it will be practicable to attain electrical activities up to 10 million horsepower (7.5 billion watts), and it is designed to serve for as many technical achievements as are possible without due expense."[14]

Tesla's calculated power levels have been conservatively estimated and recently updated with contemporary physics calculations by Dr Elizabeth Rauscher. For example, Professor Rauscher shows that the Earth's ionosphere and magnetosphere contain sufficient potential energy, *at least three billion kilowatts* (three terawatts) respectively, so that the resonant excitation of the Earth–ionosphere cavity can reasonably be expected to increase the amplitude of natural "Schumann" frequencies, facilitating the capture of useful electrical power. Tesla knew that the Earth could be treated as one big spherical conductor and the ionosphere as another, bigger, spherical conductor, so that together they have parallel plates and thus comprise a "spherical capacitor".[15] Rauscher calculates the capacitance to be about 15,000 microfarads for the complete Earth–ionosphere cavity capacitor. In 1952, W. O. Schumann predicted the "self-oscillations" of the conducting sphere of the Earth, surrounded by an air layer and ionosphere, without knowing that Tesla had found the Earth's fundamental frequency 50 years earlier.[16]

"All that is necessary," says Dr James Corum, "is that Tesla's transmitter power and carrier frequency be capable of round-the-world propagation." In fact, Tesla (in the *Los Angeles Times*, December 1904) stated: "With my transmitter I actually sent electrical vibrations around the world and received them again, and I then went on to develop my machinery." Dr Corum notes in an article on Tesla's ELF (extremely low frequency) oscillator that the tuned circuit of Tesla's magnifying transmitter was the whole Earth–ionosphere cavity.[17]

Corum explains that a mechanical analogue of the lumped-circuit Tesla coil is an easier model for engineers to understand. From a mechanical engineering viewpoint, the "magnifying factor" can be successfully applied to such a circuit. "The circuit is limited only by the circuit resistance. At resonance, the current through the circuit rises until the voltage across the resistance is equal to the source voltage. This circuit was a source of deep frustration to Edison because voltmeter readings taken around the loop did not obey Kirchoff's laws!"[18] As a result, Edison claimed such a circuit was only good for electrocution chairs.


Tesla's 187-foot Wardenclyffe Tower in 1903; it stood unfinished for the next 14 years. The two-storey power plant is in the background.

EARTH'S RENEWABLE ENERGY

Tesla's World System activates the Earth's renewable electrical storage battery, which normally sits dormant except during lightning strikes. Regarding simply the electrostatic energy storage capacity of the ionosphere, Dr Oleg Jefimenko, author of *Electrostatic Motors*, explains that during one electrical storm, the atmospheric electric field dissipates at least 0.2 terawatts (billion kilowatts), indicating that the entire Earth must have even more total available energy.[19]

Furthermore, the power loss experienced by Tesla's pulsed electrostatic discharge mode of propagation was less than five per cent over 25,000 miles. Dr Van Voorhies states that "path losses are 0.25 dB/Mm at 10 Hz"—which is so minimal it is difficult to believe for engineers who are used to transverse waves, a resistive medium and line-of-sight propagation modes that can dissipate 10 dB/km at 5 MHz."[20]

The *capacitive dome* of the Wardenclyffe Tower, like the conductive balloon of Tesla's patent #645,576, is a key to understanding the longitudinal waves. Dr Rauscher quotes Tesla: "Later he compared it to a Van de Graaff generator. He also explained the purpose of Wardenclyffe: '...one does not need to be an expert to understand that a device of this kind is not a producer of electricity like a dynamo, but merely a receiver or collector with amplifying qualities'."[21]

Only a few great physicists, like Dr Elizabeth Rauscher, Dr James Corum and Dr Konstantin Meyl,[22] have realised that Tesla was very practical when he proposed the resonant generation and wireless transmission of useful electrical power. Tesla's knowledge of atmospheric electricity transduction was so extensive and reliable that, said Jim Corum (who has been funded to continue Tesla's work): "You just have to do exactly what Tesla did and you will consistently get the same results he did."[23]

After returning from his experiments at Colorado Springs in 1900, Nikola Tesla stated: "If we use fuel to get our power, we are living on our capital and exhausting it rapidly. This method is barbarous and wantonly wasteful and will have to be stopped in the interest of coming generations."[24]

In view of our present fossil-fuel-caused global warming, Tesla seems very prophetic from his vantage point of a century ago.

HIGH TRANSMISSION INTEGRITY AND LOW LOSS

Tesla stated: "As to the transmission of power through space, that is a project which I considered absolutely certain of success long since. Years ago I was in the position to transmit wireless power to any distance without limit other than that imposed by the physical dimensions of the globe. In my system it makes no difference what the distance is. The efficiency of the transmission can be as high as 96 or 97 per cent, and there are practically no losses except such as are inevitable in the running of the machinery. *When there is no receiver, there is no energy consumption anywhere. When the receiver is put on, it draws power. That is the exact opposite of the Hertz-wave system.* In that case, if you have a plant of 1,000 horsepower (750 kW), it is radiating all the time whether the energy is received or not; but in my system no power is lost. When there are no receivers, the plant consumes only a few horsepower necessary to maintain the vibration; it runs idle, as the Edison plant when the lamps and motors are shut off."[25]

These amazing facts are explained by Corum, Spainol and Corum: "...the distinction between Tesla's system and 'Hertzian' waves is to be clearly understood. Tesla, and others of his day, used the term 'Hertzian waves' to describe what we call today energy transfer by wireless transverse electromagnetic (TEM) radiation...no one wants to stand in front of a high-power radar antenna. For these, E and H are *in phase*, the power flow is a 'real' quantity (as opposed to reactive power), and the surface integral of E x H (Poynting vector) is nonzero. The case is not so simple in an unloaded power system, an RF transformer with a tuned secondary, or with a cavity resonator. In these situations, the fields are in phase quadrature, the circulating power is reactive and the average Poynting flux is zero—*unless a load is applied*. They deliver no power without a resistive load. These are clearly the power systems which Tesla created. The polyphase power distribution system was created by him in the 1880s and inaugurated at Niagara Falls in 1895. The RF transformer was invented and patented by him in the 1890s. Terrestrial resonances he experimentally discovered at the turn of the century. And, for the next 40 years he tried to bring through to commercial reality this global power system. Today, millions of us have working scale models of it in our kitchens, while the larger version sits idle."[26]

Note that for a spherical electrostatic pulse discharge, E is radial and H is helical since *J is radial* (longitudinal or irrotational current).[27] This is a total anathema to transverse wave physics textbook images of E and H, which are normally perpendicular to each other.

BIOLOGICAL AND ECONOMIC IMPACTS

Another common criticism of the Tesla wireless power system is regarding its possible biological effects. Calculating the circulating reactive power, the Corums and Spainol find a density of *a microvar per cubic metre* at 7.8 Hz, which is quite small, while it is well-known that such a frequency is very biologically compatible.[28] The authors also look at the present 100 V/m Earth–ionosphere field and again find that raising it by a factor of 4 to 10 will pose no ill effects (thunderstorms do it all the time around the world).

In terms of economic theory, many countries will benefit from this service. Only private, dispersed receiving stations will be needed. Just like television and radio, a single resonant energy receiver is required, which may eventually be built into appliances so that no power cord will be necessary! Just think: monthly electric utility bills from old-fashioned, fossil-fuelled, lossy-electrified wire-grid delivery services will be optional, much like cable TV is today. In the 21st century, "Direct TV" is the rage, which is an exact parallel of Tesla's "Direct Electricity".

Let us fulfill this prophecy of Tesla, making it a "triumphal success" by supporting a philanthropic, international wireless power station installed on a remote island to electrify the whole world. The benefits, immediately making direct electricity available everywhere, are too numerous to count.

With California electricity rates up to 15 cents per kWh (double the US average), the old-fashioned transmission grid method is becoming too expensive to maintain.

Become educated at http://www.IntegrityResearchInstitute.org about Tesla's wireless energy transmission discovery and the Wardenclyffe Tower's potential for transforming the world's generation and delivery of electricity. Read *Harnessing the Wheelwork of Nature: Tesla's Science of Energy* for more details about this discovery and other fascinating aspects of Tesla's inventions. ∞

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Thomas Valone received his Master's in Physics from the State University of New York at Buffalo (1984) and his PhD in General Engineering from Kennedy–Western University (2003). He taught physics, AC electricity, microprocessors, digital logic and environmental science at Erie Community College in New York state (1982–1987). He is the author of about 100 articles and reports and several books, and also the editor of *Harnessing the Wheelwork of Nature* (2002). Dr Valone is President of Integrity Research Institute, a non-profit organisation dedicated to energy research and education. For more details, visit http://www.IntegrityResearchInstitute.org or email Dr Valone at iri@erols.com.

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